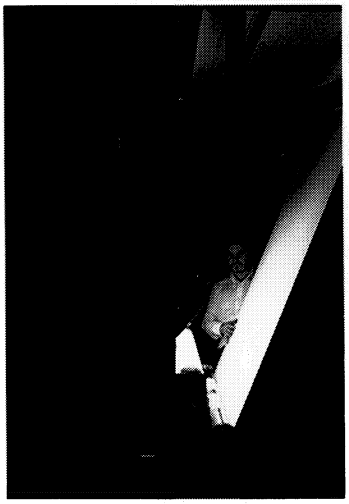

Chatham Manufacturing Company, Elkin, North Carolina is a large manufacturer of fabrics for furniture, auto interiors, wearing apparel, rugs, carpets and other products. Shown above is a display of Chatham blankets, produced by a patented Fiberwoven process on looms such as the one shown at left, where a company employee is inspecting a finished blanket for flaws. The looms were designed and built by Chatham Research and Development, a division of Chatham Manufacturing also located in Elkin.

A key element in the machines' operation is the rocker arm assembly, a welded steel structure (right foreground in the lower right photo) that oscillates at very high speed, driving an array of barbed needles through the batt of fibers, thus entangling them to form the fabric. When the machines were first put into service, engineers discovered that the rapid oscillation created a problem for Chatham and other manufacturers to whom Chatham leases looms: it accelerated metal fatigue and caused fractures in the metal, a significant matter due to the high cost of replacing parts.

Chatham R&D tried to select materials and fabrication techniques to minimize the problem. They succeeded in reducing the incidence of failure, but the failure rate was still far too high. At that point, Chatham R&D sought problem solving assistance from the North Carolina Science and Technology Research Center (NC/STRC), Research Triangle Park, North Carolina, one of nine NASA-sponsored dissemination centers that provide information and technical help to industrial and government clinics. NC/STRC conducted a computer search of the NASA data bank and provided a number of reports on metal fatigue and crack propagation, several of which proved particularly pertinent and helpful in finding a solution.

Chatham R&D determined that metal fatigue was caused by tensile stress, that such stresses varied widely within a given piece of metal and that cracks generally develop on the surface; their goal, therefore, was to find a way of reducing surface tensile stresses. The NASA-provided literature

suggested a method of doing that: build in a residual compressive stress; any tensile load applied to the part would have to overcome the compressive stress before the surface was put into tension, thus the resultant tensile load on the surface would be lessened.

The only practical method for creating compressive stress on large irregular surfaces, such as those of the loom machines, was by "shot peening," a technique in wide use in the manufacture of aircraft engine components and other aerospace parts. Shot peening consists of bombarding a part with a high velocity stream of very small shot, which act like thousands of tiny ball peen hammers pounding and compressing the surface of the part. Chatham R&D purchased a standard shot peening machine, modified it to handle the company's bulky machine parts and it proved to be the solution. Since then, Chatham has shot peened all moving parts of its machines, such as the rocker arm shown at right above; the black metal in foreground is unpeened, the silvery metal is a peened rocker arm and the tiny shot employed is shown on the fingers and in the mount at

left. In eight years of using the technology, Chatham has not had a single failure of a part that had been shot peened and the savings are estimated to approach a quarter million dollars annually. ▲